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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/602,721	06/25/2003	Chandra Mouli	M4065.0761/P761	9931
24998	7590	06/27/2005	EXAMINER	
DICKSTEIN SHAPIRO MORIN & OSHINSKY LLP			LEE, EUGENE	
2101 L Street, NW			ART UNIT	
Washington, DC 20037			PAPER NUMBER	
			2815	

DATE MAILED: 06/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/602,721

Applicant(s)

MOULI ET AL.

Examiner

Eugene Lee

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 May 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10, 12-33, 35-37 and 59-65 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-10, 12-33 and 35-37 is/are allowed.
- 6) ☒ Claim(s) 59-65 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 24 November 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/26/05 has been entered.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the channel region ... located below the bottom surface of the gate (claims 1, 20, 24, and 59) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an

Art Unit: 2815

application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 59 thru 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koizumi et al. 6,661,459 B1 in view of Yasaka 611-174765 JPO. Koizumi discloses (see, for example, FIG. 3) a pixel cell comprising a p-well (substrate) 102, transfer gate region (gate) 103, transfer transistor, and a photoelectric conversion element wherein the photoelectric conversion element comprises a p-layer (doped surface layer of a first conductivity type) 105, and n-layer (doped region of a second conductivity type) 106. Koizumi does not disclose a gate of a transistor formed in the trench, the gate having a bottom surface below the surface of the substrate; a channel region of the transistor located below the bottom surface of the gate; and the doped surface layer is at least partially above a level of a bottom surface of the gate. However, Yasaka discloses (see, for example, figure 1) a structure comprising a V-shaped groove (trench), transfer electrodes 2/3, transfer channel 4, P+ region (doped surface layer), and N region 6. The P+ region is above a level of a bottom surface of the transfer electrodes 2/3. In the abstract,

Art Unit: 2815

Yasaka states that the width of the transfer channel is increased, thereby increasing the maximum charge transferred. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention to have a gate of a transistor formed in the trench, the gate having a bottom surface below the surface of the substrate; a channel region of the transistor located below the bottom surface of the gate; and the doped surface layer is at least partially above a level of a bottom surface of the gate in order to substantially increase the width of the transfer channel in order to increase the maximum charge transferred, and obtain a broader dynamic range.

Regarding claim 60, see FIG. 3 wherein Koizumi discloses a p-layer 105 and n-layer 104 which collectively form a pinned photodiode.

Regarding claim 61, see column 4, line 19 wherein Koizumi discloses a transfer transistor.

Regarding claim 62, it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed (i.e. in a reset transistor or charge coupled device) does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations, *Ex Parte Masham*, 2 USPQ F. 2d 1647 (1987).

Regarding claim 63, see FIG. 3 wherein Koizumi discloses a floating diffusion (sensing node) 107.

Regarding claims 65, Koizumi in view of Yasaka does not disclose the trench having a depth within the range of approximately 500 to approximately 2500 Å. However, the depth of the trench is a result effective variable that one of ordinary skill in the art would optimize for forming the transfer gate in a semiconductor device. Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made to have the trench have a depth

Art Unit: 2815

within the range of approximately 500 to approximately 2500 Å in order to form an adequate gate in a semiconductor device to transfer charge, and since it has been held that discovering the optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F. 2d 272, 205 USPQ 215 (CCPA 1980).

Allowable Subject Matter

5. Claims 1 thru 10, 12 thru 33, 35 thru 37, and 59 thru 65 are allowed. The following is a statement of reasons for the indication of allowable subject matter: The references of record, either singularly or in combination, do not teach or suggest at least a **pixel cell** comprising: a gate of a transistor formed at least partially **below** a surface of the substrate, the gate having a bottom surface below the surface of the substrate; a **photo-conversion device** formed **adjacent** to the gate, a doped surface layer of a first conductivity type, and a doped region of a second conductivity type underlying the doped surface layer, wherein the **second conductivity type layer is at a level below the level of the bottom surface of the gate**. Fossum 5,055,900 discloses a gate below a surface of the substrate, and a doped surface layer of a first conductivity type, however, Fossum does not disclose the second conductivity type layer (which is underlying the doped surface layer) wherein the second conductivity type layer is at a level below the level of the bottom surface of the gate (claims 1-10, and 12-19).

Regarding claims 20-23, the references of record, either singularly or in combination, do not teach or suggest at least a **pixel cell** comprising: a trench in the substrate; a gate of a transistor at least partially in the trench; a **photo-conversion device** formed **adjacent** to the gate, a doped layer of a first conductivity type below the surface of the substrate, and a doped region

Art Unit: 2815

of a second conductivity type underlying the doped layer of a first conductivity type, wherein the **second conductivity type layer is at a level below the level of the bottom surface of the gate.**

Regarding claims 24-33, and 35-37, the references of record, either singularly or in combination, do not teach or suggest at least an imager system comprising: a pixel comprising: a gate of a transistor formed at least partially **below** a surface of the substrate, the gate having a bottom surface below the surface of the substrate; a **photo-conversion device** formed **adjacent** to the gate, a doped surface layer of a first conductivity type, and a doped region of a second conductivity type underlying the doped surface layer, wherein the **second conductivity type layer is at a level below the level of the bottom surface of the gate.**

Response to Arguments

6. Applicant's arguments with respect to claims 1-10, 12-33, 35-37, and 59-65 have been considered but are moot in view of the new ground(s) of rejection.

INFORMATION ON HOW TO CONTACT THE USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eugene Lee whose telephone number is 571-272-1733. The examiner can normally be reached on M-F 8-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on 571-272-1664. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Art Unit: 2815

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Eugene Lee
June 20, 2005

A handwritten signature in black ink, appearing to be 'Eugene Lee', with a stylized, flowing script.